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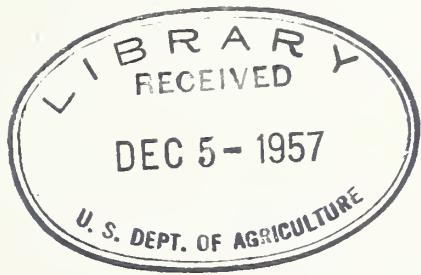
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TWO-WAY RADIO OPERATION MANUAL

Plant Pest Control Division
Agricultural Research Service
U. S. Department of Agriculture

933273

FOREWORD

This manual includes information from the manufacturer's Instruction Manuals for Mobile FM two-way radio, Part No. 68P839280-B and Handie-Talkie FM two-way radio, Part No. 68P845740-A. It is intended to furnish brief but adequate information for the operation of these radio units. Additional and more detailed information may be found in the Motorola Manuals.

AUTHORIZATION

The Interdepartmental Radio Advisory Committee for the Federal government has assigned a fixed frequency, 171.525 megacycles, to the Plant Pest Control Division for its exclusive use throughout the United States. The operation of PPC radios is authorized and governed by regulations of the Federal Communications Commission and IRAC. The frequency in these radios is crystal controlled and it is therefore important that no adjustments be made except by an authorized Motorola two-way radio service representative.

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DEPARTMENT OF AGRICULTURE
Washington 25, D. C.

FREQUENCY AUTHORIZATION
USDA RADIO STATION

ARS No. 5
Serial No.

September 12, 1956

I. Agricultural Research Service

II. Frequency Type of Emission Class of Station
171.525 mc 36F3 MO

III. Transmitter Location Call Sign Lat. & Long. Max. Ant. Power KW
U. S. Group - - - 0.050

IV. Remarks

For use in conducting aerial spraying projects in connection
with control of insect infestations.

V. Authority Reference

Agriculture Application A-1-56; FAS Docket No. 15844.

/s/ E. Allan Loew
E. Allan Loew
Department of Agriculture, Representative
Interdepartment Radio Advisory Committee

DESCRIPTION

Two types of radios have been procured. One type is called a Mobile radio, which has a 25-watt output and is powered by either a 6 or a 12-volt battery. It is intended to use this type radio at the airstrips and in motor vehicles. When this type is installed in a vehicle, it can be connected to the vehicle's electrical system, thus using the vehicle's battery for a source of power. Normal driving and occasional running of the engine should keep the battery charged if the generator is operating.

When this type radio is installed in an office, a 6 or 12-volt battery must be provided for a power supply. In this case, provision should be made to keep this battery charged by providing a portable generator system, or have it recharged by an outside source. The most efficient radio operation is obtained when the battery is fully charged.

The other type is a Portable radio, often called a "Handie-Talkie" or "Packset." It has a 5-watt output and is powered by its own self-contained battery-pack, which is a nickel-cadmium rechargeable battery that is sealed and spillproof. The radio can be operated approximately 8 hours before the battery must be recharged. It is intended to use this type in observation or supervisory aircraft and if it is connected to the aircraft electrical system, a trickle-charger in the unit will recharge the battery. Under normal conditions, two hours of trickle-charge will provide approximately one hour of radio operation. Since it is intended to use this type radio in the observation aircraft and connect it to the electrical system, it is believed that the batteries will not require recharging from an outside source.

IMPORTANT

The nickel-cadmium battery in the portable radio should not be recharged with a conventional battery charger. This would seriously damage the unit.

These are FM radios and depend substantially on "line of sight" for most efficient operation. When installed in motor vehicles, it must be remembered that in hilly or mountainous terrain, best

results are obtained when the vehicle is parked on a hilltop. An attempt should be made to keep a clear "line of sight" between any two radios that are being used for intercommunication. When this cannot be done, it may be possible to contact an operator with a radio in another position and he may be able to relay the messages. This is especially true if a radio equipped observation aircraft is in the vicinity.

DISTRIBUTION OF EQUIPMENT

It is suggested that the distribution of radio equipment be made to best suit the work, giving consideration to the equipment available and the size of the spray program. The tentative plan is to provide a combination of four radios as a communication network for each airstrip. Each network will be comprised of one portable and three mobile radios. One mobile unit will be stationed at the airstrip, two mobile units installed in motor vehicles that will be used in observing the work of the spray planes in the field, and the portable radio will be used in the observation or supervisory aircraft.

It is the intention of the Plant Pest Control Division that this radio equipment be available for use by any of its control activities when the need arises. It is therefore important that any equipment installation be considered "temporary" and that all packaging cartons be saved for future use.

It is understood and agreed that workmanship and materials (except vacuum tubes) in each unit carry a 90-day operational guarantee; if a unit fails within this period for any reason other than accident, tube failure or misuse, contractor will immediately restore same to first-class condition without charge and pay transportation costs to and from his designated service center from any point of field use within the continental United States.

The Forest Service (under whose contract these radios were purchased) reserves one year, if necessary, in which to accomplish the guaranteed use. The Forest Service will be the judge as to whether or not a unit fails to perform.

REGULATIONS

A radio operator's license is not required to operate a Federal government radio. However, the operation of two-way radio equipment puts a responsibility on each user. Federal Communication Commission regulations prohibit the use of profane or indecent language on radio transmissions and limit communication to business related to official government operations.

Except as noted below, the Communications Act of 1934 makes it unlawful to intercept a radio message (which includes official conversations) or to divulge the contents or even existence of any message by wire or radio to any person except the addressee or his agent. Exceptions are: messages sent by amateurs or others for the benefit of the general public, or relating to ships in distress. The Federal law imposes heavy penalties for violations.

Under "Conelrad" emergencies, which apply in the event of an enemy attack or during simulated drills, Federal law permits only certain specified radio operations and they must be carried on without revealing the location of the operating units. All other stations must remain silent. Therefore, prior to beginning operations with this radio equipment in a given locality, the local Air Raid Alert agency or police department should be contacted so they can inform your Base Station if an alert should occur.

"MAYDAY" is the international radio-telephone distress signal. Distress messages have priority. If a serious emergency arises, the word "MAYDAY" should be repeated several times prior to transmitting the message. All other stations on the frequency should immediately terminate any transmission they may be making and stand-by to assist if the need arises.

When interference is experienced from other radio stations in or near the same frequency, but not part of the Division's network, an effort should be made to share the frequency, if possible. Should the interference be excessive or the source unknown, the IRAC should be advised and they in turn will take up the matter with FCC.

OPERATION INSTRUCTIONS

General

International call signs have not been assigned to these Mobile and Portable radios. Therefore, a means of identifying each radio network and each station in the network will be required. Such identification will also be necessary to eliminate confusion, and to direct calls to the intended recipient.

Each network should therefore be identified by the name of the airstrip at which the Base Station is located. When starting and terminating use of the radio network each day, the Base Station should announce its geographical location along with its call sign.

For example, if a network Base Station were located at Matamoras Airport, Matamoras, Pennsylvania, it might start the operation in the morning by announcing: "This is the USDA Base Radio Station, Matamoras-One, located at the Matamoras Airport, Matamoras, Pennsylvania, testing and starting operations for the day."

A similar identification and location would be announced when closing down for the day or any period during the day.

Other Mobile stations on the Matamoras network would use the same name.

Example: "Matamoras-Two" for a Mobile radio in one vehicle
"Matamoras-Three" for the next unit and so on.

The airborne Portable radio should use the last 3 numbers or letters of the aircraft's registration number preceded by the make of the aircraft.

Example: "Cessna 43Charlie," using the phonetic word "Charlie" for C. This refers to the 180 Cessna, whose registration number is N1643C.

Use of Codes

To facilitate the use of the radio network and make all communications as brief as possible, a system of code numbers can be worked out that will permit certain form questions or replies to be made by merely transmitting 2 numbers.

Such a code, known as the "Ten-Code" has been established and is used universally by amateur, police, fire department, and many other two-way mobile radio operators throughout the United States.

Those parts of the "Ten-Code" which may be useful in the operation of the Division's radios are listed. However, they should not be changed or added to. A card showing codes developed for the Division's use could be attached to each radio for easy reference by the operator.

TEN-CODE

- 10-1 Receiving poorly
- 10-2 Receiving well
- 10-3 Stop transmitting
- 10-4 I have received and understand your message
- 10-5 Verbal repeat
- 10-6 Stand-by (will call)
- 10-7 Out of service (radio turned off _____ minutes)
- 10-8 In service (radio turned on)
- 10-9 Repeat beginning with _____
- 10-11 Slow up (talking too fast)
- 10-20 What is your location?
- 10-25 Do you have contact with _____ ?

A separate code for messages specifically associated with Division spray program work should be compiled as the need arises. The Forest Service has a "Four-Code" for its requirements. It is therefore suggested that a Seven-Code, similar to the following, be used by the Division.

SEVEN-CODE

Weather or Spray Conditions:

- 7-1 Too windy or turbulent to spray
- 7-2 Fog or rain in area (identify, if necessary)
- 7-3 Shut down -- Spray drifting or rising
- 7-4 OK to spray

Aircraft Spray System: When referring to a specific aircraft, identify it by name or number.

- 7-5 Spray system leaking
- 7-6 Spraying enroute to area or during turnaround
- 7-8 Plugged nozzles
- 7-9 Hold on ground 'til I get there

Pilot Performance: Identify by name or plane number

- 7-11 Too high
- 7-12 Too low
- 7-13 Swath spacing too wide
- 7-14 Swath spacing too narrow
- 7-15 In wrong area

Operation of Mobile Radios

Before placing a Mobile station in operation, the following checks should be made:

A. General

Check all lugs, cable connections, fuses, and bolted connections.

B. To Turn Equipment "ON"

Turn the VOLUME control clockwise. A click will be heard when the switch is actuated and the green indicator light will become illuminated. The receiver is now in full operation.

C. To Receive

1. Turn the VOLUME control to the full clockwise position.
2. Turn the SQUELCH control to the full counterclockwise position.
3. Adjust the SQUELCH control, by turning the control slowly clockwise until the noise is just squelched (cut out). If the control is turned beyond this point, weak signals may be blocked out.
4. Set the volume control to the desired speaker level with a received signal.

D. To Transmit

1. Remove the microphone from the hanger bracket and press the push-to-talk button. The red indicator light will become illuminated, indicating the transmitter is "on." The standard microphone furnished with the Mobile radios will work best if a normal tone of voice is used -- loudness creates background noises. The receiver is inoperative when the push-to-talk button is depressed, therefore it must be released at the end of a transmission to receive a reply.
THIS TRANSMITTER CANNOT BE OVER-MODULATED BY SPEAKING LOUDLY.
2. To receive reply, release the push-to-talk button. The red indicator light will go "off" and the green light will come "on." The received reply may now be heard over the speaker and/or the headset when used.
3. When the communication is completed, hang the microphone in the hanger bracket.

E. To Turn Equipment "OFF"

Turn the VOLUME control counterclockwise. A click will be heard when the switch is actuated and the green indicator light will go "off."

IMPORTANT

Never start a motor vehicle engine when radio is "on."

Operation of Portable Radio

A. To Turn Equipment "ON"

Remove microphone from its cradle and turn the "ON-OFF" knob counterclockwise to "ON" and pull up. This places the receiver in operation.

B. To Receive

1. Adjust volume control (marked V) until the desired amount of volume is obtained from the speaker or headset.
2. Turn squelch knob (marked S) to the full counterclockwise position.
3. Adjust the SQUELCH control, by turning the control slowly clockwise until the noise is just squelched (cut out). If the control is turned beyond this point, weak signals may be blocked out.

C. To Transmit

1. Follow the same procedure as outlined under the Mobile operation described in paragraph D-1 above.

NOTE

Should the Portable radio be used in a ground vehicle at the limits of range, additional range may be obtained if the radio is placed on the hood or top of the car. This helps to furnish a good ground plane for the antenna.

2. To receive reply, follow procedure described in paragraph D-2 above.

D. To Turn Equipment "OFF"

The "ON-OFF" button may be pushed down and turned clockwise. However, the unit is automatically turned off when the microphone is replaced in the cradle face down. Placing microphone in the cradle face up leaves the receiver on for constant monitoring.

Operating Procedure

It is important to remember that this type of radio cannot receive a message during the interval that it is being used to transmit. Therefore, it is impossible to interrupt the individual who is transmitting, as one might on a telephone, until he has completed his transmission.

* It must also be remembered that all Division radios operate on the same frequency. Therefore the messages should be as brief as possible. At such times that a communication will require more than a brief transmission, it should be interrupted at regular intervals, maintaining silence for 5 to 10 seconds, so that other stations may place urgent calls if necessary.

The following procedure shall be observed by operators of Division radio stations:

1. Insofar as network design permits, check to be sure no one else is transmitting. Do not break in if you will cause interference, except in an emergency.
2. Identify station called, then station calling, by use of the assigned call sign.

Example: "Matamoras-One calling Matamoras-Three,
over."

3. Use the word "over" at the end of a single transmission to indicate that you are waiting for the other station to answer. This is optional and need be used only when the transmission conditions are poor.

4. Do not repeat call signs after contact is made until the communication is terminated.
5. Be brief and pronounce words clearly when transmitting. Use phonetic code (i.e., Charlie for "C") to spell out difficult words, if necessary.
6. The "Ten-Code" and "Seven-Code" should be used when applicable.

BASE STATION ANTENNA MAST

A special antenna is required for use with the Mobile radios located at the airstrip selected for the Base Station. To assure good transmission and reception with the base radio, this special antenna unit should be erected atop a mast approximately 30 feet high. The mast should be erected well away from any buildings of equivalent height.

The Base Station antenna is furnished with a 50 foot antenna lead. This lead should not be cut to shorten it, nor should it be lengthened. The lead enters the antenna assembly through a 45° $3/4"$ elbow. The lower end of the elbow is fitted with a $3/4"$ close nipple. The upper end of the elbow is threaded onto a section of $3/4"$ pipe which extends into the ground section of the antenna. The above parts make up the antenna assembly and should never be separated.

A suitable antenna mast can be erected with the following parts:

- 1 - $3/4"$ to $1"$ reducer
- 1 - 10' length of $1"$ pipe
- 1 - $1"$ to $1\frac{1}{4}"$ reducer
- 1 - 10' length of $1\frac{1}{4}"$ pipe
- 1 - $1\frac{1}{4}"$ to $1\frac{1}{2}"$ reducer
- 1 - 10' length of $1\frac{1}{2}"$ pipe
- 1 - 5' length of $2" \times 2" \times 1/4"$ angle iron
- 2 - Steel "U" clamps for clamping angle iron and $1\frac{1}{2}"$ pipe together
- 150' - $1/4"$ rope

Assemble the parts in the order listed to make a mast 30' in length. Screw the antenna assembly into the 3/4" to 1" reducer on the mast top. Be careful not to twist or kink the antenna lead.

Cut the 150' rope into 3 equal lengths and attach one end of each to the mast just above the 1" or 1 1/2" reducer.

At the spot selected for the antenna mast, drive the angle iron into the ground to a depth equal to half its length or more. Place the lower end of the mast into the "V" of the angle iron and raise the mast by walking it up and pulling on the guy ropes. When the mast is vertical, clamp it to the angle iron with the "U" clamps and drive stakes at 3 equally spaced locations about the mast to which the guy ropes should be tied.

INSTALLATION AND MAINTENANCE

This subject is covered in another Manual.

